Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery During January – June, 2004

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Background

The U.S. Atlantic Pelagic Longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the central North Atlantic ocean. The longline fishery has a documented history of incidental takes of non-target species including billfish, marine turtles, and marine mammals. During recent years there have been elevated takes of leatherback turtles in the Gulf of Mexico (Garrison, 2003). As a result, a Biological Opinion was recently developed by the NOAA Fisheries Southeast Regional Office (SERO) under the Endangered Species Act requiring several actions to be taken to improve monitoring and reduce interactions with leatherback turtles.

Included in these actions was quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report is the first of these quarterly reports and includes the fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from January 1, 2004 to June 30, 2004.

While it would be desirable to estimate the absolute level of takes (i.e., total number of turtles taken), this is not currently possible because the fishery effort data is reported on logbook forms by fishing captains. These data are not available or have not been processed until several months after the end of any given quarter. Therefore, I present the bycatch rate (i.e., catch per unit effort) based solely on observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate for each quarter and fishing area during 2004 is compared to that observed in 2003 and the average of the previous five years (1999-2003) to assess whether or not the observed rate in 2004 is unusually high or low. Bycatch rates are calculated applying the delta log-normal method using hooks as the unit of effort, and the analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of 193 longline sets (~137,000 hooks) were observed during quarter 1, and 157 (~114,000 hooks) were observed during quarter 2 (Table 1). The Gulf of Mexico had the highest number of observed sets in both quarters. In addition to standard fishery effort, an experimental fishing program was implemented in the GOM during the first two quarters of 2004 to examine the effects of hook and bait types on bycatch rates of marine turtles. There were 40 experimental sets observed in GOM during quarter 1 and 20 in quarter 2 (GOM-E in Table 1).

There were 22 observed interactions with leatherback turtles during quarter 1 and 34 interactions during quarter 2 (Table 2a). The take levels were lower for loggerhead turtles with 27 observed interactions during quarter 1 and only 3 observed interactions in quarter 2 (Table 2b). All marine turtles were recorded as being released alive. The locations of observed sets and turtle interactions are shown in Figures 1 and 2.

There were a total of 3 marine mammal interactions observed, all with pilot whales (*Globicephala spp.*), during quarter 1 (Table 3). In each case, the mammal was determined to be seriously injured based upon the description of interactions with the fishing gear by the observer and established serious injury criteria (see Garrison, 2003). Interactions with pilot whales were observed in the CAR and MAB regions (Figure 3).

The quarterly and regional bycatch rates are summarized for leatherback and loggerhead turtles in Table 4 and for pilot whales in Table 5. These rates are compared with those from the same quarter/area for 2003 and the average from 1999-2003 in Tables 6-8. Specific information on injuries to sea turtles and hook characteristics of each set are shown in Appendix A.

For leatherback turtles, the take rates observed in quarter 1 for the CAR, FEC, and GOM areas were consistent with those observed in previous years. In each case, the rate observed during 2004 was similar or were included in the 95% confidence intervals for those of previous years. The CPUE value for the SAB area during quarter 1 was very high, but also had a very high level of uncertainty given that only one set was observed in this region. Catches of leatherback turtles in the SAR region during quarter 1 were observed during 2004 but had not been observed in the previous five years (Table 6). Leatherback turtle catches in the CAR, FEC, and GOM regions were somewhat elevated during quarter 2 of 2004 compared to previous years, though the estimates for the CAR and FEC are highly uncertain due to low sample size. Take rates observed in GOM during quarter 2 of 2004 were more than double those of previous years (Table 6).

For loggerhead turtles, the bycatch rates during quarter 1 of 2004 were typically lower than those in previous years. In the GOM, MAB, and NCA areas, no loggerhead turtle takes were observed in 2004, but catches were observed during the previous five years (Table 7). The loggerhead turtle catch rate was high in the FEC area; however, this estimate is very uncertain due to low sample sizes and therefore comparisons with previous years are unreliable. During quarter 2, very few loggerhead turtles were observed caught by the longline fishery, and the catch rates are generally lower than those for the previous five years (Table 7).

The bycatch rate for pilot whales in quarter 1 for the MAB region is consistent with that observed in previous years; however, interactions with pilot whales has not previously been observed for the CAR region (Table 8). Beaked whales, unidentified dolphins, and pygmy sperm whales have also been previously observed captured during quarter 1 in various regions, but interactions with these species did not occur in 2004. No marine mammals were captured during quarter 2 of 2004; however, interactions have been observed during this period in past years in particular with pilot whales in the FEC, MAB, and SAB regions.

Much of the recent management action has focused on the role of hook type in influencing interaction rates with turtles. During the first 2 quarters of 2004, the vast majority of the observed fishing effort used "J" hooks primarily of the 7/0 and 9/0 size classification (Figure 4a). In some cases, more than one hook size was used on a single set. Circle hooks were used only very occasionally in observed sets. Larger 16/0 and 18/0 circle hooks were used only in experimental sets in the Gulf of Mexico and were used only in combination. With the exception of 3 leatherback turtles captured in experimental sets, the majority of turtles were captured on 7/0 or 9/0 "J" hooks (Figure 4b).

There are a number of caveats and uncertainties that are associated with the current analysis. First, these data should be considered preliminary. While they have gone through an initial audit and review, the data are subject to change upon further review at the end of the 2004 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch rates primarily to maintain consistency with previous estimates for this fishery (e.g., Garrison 2003). This approach assumes 1) that catch rates (animals per hook) are lognormally distributed and 2) that the number of hooks is an appropriate unit of effort. The first assumption has been evaluated for turtles; however, the delta estimator is sensitive to the assumption of log-normality, and violations of this assumption may result in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. The current approach assumes that total bycatch is linearly related to the total number of hooks fished. If this assumption is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there is potentially a bias in the estimate of bycatch rate and total bycatch.

The interaction between longline gear and marine turtles is a relatively rare event and is therefore inherently variable. Historically, there have been very large interannual fluctuations in bycatch rates and therefore estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may be simply stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NOAA FISHERIES-SEFSC-515, 52 p.

Table 1. Number of (A) Hooks (x1000) and (B) Sets observed in the U.S. Atlantic Pelagic Longline Fishery between January – June 2004. "GOM-E" indicates experimental sets in the Gulf of Mexico.

A. Number of Hooks (x 1000)

	Quarter	
Area	**1**	**2**
CAR	20.33	11.74
FEC	14.55	1.45
GOM	42.84	52.17
GOM-E	19.74	10.55
MAB	6.80	13.47
NCA	2.90	0.00
SAB	0.80	25.22
SAR	28.85	0.00

B. Number of Sets

	Quarter	
Area	**1**	**2**
CAR	23	16
FEC	31	5
GOM	50	61
GOM-E	40	20
MAB	13	18
NCA	3	0
SAB	1	37
SAR	32	0

Table 2. Total observed interactions with (A) Leatherback and (B) Loggerhead Turtles in the U.S. Atlantic Pelagic Longline Fishery between January – June 2004. "GOM-E" indicates experimental sets in the Gulf of Mexico. All turtles were recorded as being released alive.

A. Leatherback Turtles

	Quarter	
Area	**1**	**2**
CAR	1	1
FEC	5	1
GOM	6	25
GOM-E	2	1
MAB	0	5
NCA	0	-
SAB	1	1
SAR	7	-

B. Loggerhead Turtles

	Quarter	
Area	**1**	**2**
CAR	5	1
FEC	7	0
GOM	0	0
GOM-E	0	0
MAB	0	0
NCA	0	-
SAB	1	2
SAR	14	-

Table 3. Interactions with marine mammals observed during January –June 2004 in the U.S. Atlantic Pelagic Longline Fishery. Animals were determined to be "seriously injured" based upon observer comments and criteria described in Angliss and Demaster (1998).

Species	Region	Quarter	# Caught	# Dead	# Serious Injury
Pilot Whale	MAB	1	1	0	1
Pilot Whale	CAR	1	2	0	2

Table 4. Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and quarter during Jan.-Jun. 2004 in the U.S. Atlantic Pelagic longline fishery. "GOM-E" indicates experimental sets in the Gulf of Mexico. CV indicates the coefficient of variation of the estimated rate. All turtles were recorded as being released alive.

A. Leatherback Turtles

Area	Quarter	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
CAR	1	1	23	0.0566	0.0032	1.00
FEC	1	5	31	0.2439	0.0110	0.43
GOM	1	5	50	0.1213	0.0029	0.45
GOM-E	1	2	40	0.0926	0.0045	0.72
SAB	1	1	1	1.2438	1.5470	1.00
SAR	1	6	32	0.1933	0.0057	0.39
CAR	2	1	16	0.0710	0.0050	1.00
FEC	2	1	5	0.5970	0.3564	1.00
GOM	2	19	61	0.4620	0.0098	0.21
GOM-E	2	1	20	0.0694	0.0048	1.00
MAB	2	4	18	0.3329	0.0259	0.48
SAB	2	1	37	0.0334	0.0011	1.00

B. Loggerhead Turtles

Area	Quarter	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
CAR	1	5	23	0.2600	0.0112	0.41
FEC	1	7	31	0.5480	0.0402	0.37
SAB	1	1	1	1.2438	1.5470	1.00
SAR	1	8	32	0.4273	0.0234	0.36
CAR	2	1	16	0.0682	0.0047	1.00
SAB	2	2	37	0.0634	0.0020	0.69

Table 5. Estimated bycatch rate (Catch per 1000 hooks) for pilot whales by geographic area and quarter during Jan.-Jun. 2004 in the U.S. Atlantic Pelagic longline fishery. CV indicates the coefficient of variation of the estimated rate. All pilot whales were recorded as being seriously injured.

Area	Quarter	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
CAR	1	2	23	0.0923	0.0004	0.69
MAB	1	1	13	0.0974	0.0094	1.00

Table 6. Summary of quarterly bycatch rates for Leatherback turtles in the U.S. Atlantic longline fishery during January – June, 2004 and comparison to rates from the previous year (2003) and the average of the previous five years (1999-2003). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates.

Area	Quarter	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
CAR	1	0.0566	0.0116 - 0.2767	0.0000	-	0.1278	0.0533 - 0.3065
FEC	1	0.2439	0.1114 - 0.534	0.1006	0.0339 - 0.2981	0.2068	0.119 - 0.3595
GOM	1	0.1213	0.0539 - 0.2732	0.1653	0.0934 - 0.2923	0.0794	0.0491 - 0.1283
MAB	1	0.0000	-	0.1889	0.0387 - 0.9237	0.0436	0.0089 - 0.2132
NCA	1	0.0000	-	0.0000	-	0.0294	0.0060 - 01435
NEC	1	0.0000	-	0.0000	-	0.0000	-
SAB	1	1.2438	0.2544 - 6.08	0.7440	0.2287 - 2.4203	0.5923	0.3126 - 1.1223
SAR	1	0.1933	0.0945 - 0.3955	0.0000	-	-	-
CAR	2	0.0710	0.0145 - 0.3472	0.0000	-	-	-
FEC	2	0.5970	0.1221 - 2.9184	0.0000	-	0.0525	0.0147 - 0.1878
GOM	2	0.4620	0.3088 - 0.6912	0.1871	0.0901 - 0.3885	0.1540	0.1091 - 0.2175
MAB	2	0.3329	0.139 - 0.7974	0.7680	0.2414 - 2.4434	0.1915	0.0808 - 0.4539
NCA	2	0.0000	-	0.0384	0.0079 - 0.1877	0.0259	0.0053 - 0.1265
NEC	2	0.0000	-	0.3053	0.0624 - 1.492	0.1089	0.0402 - 0.2957
SAB	2	0.0334	0.0068 - 0.1631	0.0000	-	0.0696	0.0342 - 0.1413
SAR	2	0.0000	-	0.0000	-	0.0000	-

Table 7. Summary of quarterly bycatch rates for Loggerhead turtles in the U.S. Atlantic longline fishery during January-June 2004 and comparison to rates from the previous year (2003) and the average of the previous five years (1999-2003). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates.

Area	Quarter	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
CAR	1	0.2600	0.1231 - 0.549	0.2894	0.0592 - 1.4144	0.3057	0.1648 - 0.5671
FEC	1	0.5480	0.2789 - 1.0768	0.2619	0.1279 - 0.5363	0.1852	0.1098 - 0.3124
GOM	1	0.0000	-	0.0137	0.0387 - 0.9237	0.0193	0.0067 - 0.0558
MAB	1	0.0000	-	0.1890	0.1154 - 0.9659	0.1768	0.0749 - 0.4172
NCA	1	0.0000	-	0.3339	0.4442 - 1.4757	0.2235	0.1039 - 0.4808
NEC	1	0.0000	-	0.0000	-	0.0000	-
SAB	1	1.2438	0.2544 - 6.0800	0.0000	-	0.0305	0.0062 - 0.1492
SAR	1	0.4273	0.2206 - 0.8279	0.8096	0.4442 - 1.4757	0.6882	0.3692 - 1.2827
CAR	2	0.0682	0.014 - 0.3334	0.0000	-	0.0000	-
FEC	2	0.0000	-	0.0000	-	0.0967	0.0377 - 0.2478
GOM	2	0.0000	-	0.0423	0.0125 - 0.1424	0.0326	0.0163 - 0.0654
MAB	2	0.0000	-	0.0000	-	0.0266	0.0054 - 0.1299
NCA	2	0.0000	-	0.2324	0.0945 - 0.5718	0.2075	0.0986 - 0.4366
NEC	2	0.0000	-	2.4735	0.8603 - 7.1124	0.6814	0.3407 - 1.3629
SAB	2	0.0634	0.0193 - 0.2077	0.1364	0.0416 - 0.4477	0.0732	0.0325 - 0.1648
SAR	2	0.0000	-	0.0000	-	0.0000	-

Table 8. Summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during quarters 1 (A) and 2 (B) of 2004 and comparison to rates from the previous year (2003) and the average of the previous five years (1999-2003). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

(A) Quarter 1

Species	Area	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
Beaked Whale	CAR	0	-	0.4762	0.0974 – 2.3278	0.0501	0.0103 – 0.2450
Beaked Whale	SAR	0	-	0.0613	0.01254 – 0.2995	0.0521	0.0107 – 0.2546
Unid. Dolphin	GOM	0	-	0.0189	0.0038 – 0.09241	0.0061	0.0013 – 0.0300
Pilot Whale	CAR	0.0923	0.0281 – 0.3034	0	-	0	-
Pilot Whale	MAB	0.0974	0.01992 – 0.4759	0	-	0.1012	0.0207 – 0.4948
Pygmy Sperm Whale	FEC	0	-	0	-	0.0165	0.0033 – 0.0808

(B) Quarter 2

Species	Area	2004 CPUE	2004 95% CI	2003 CPUE	2003 95% CI	1999-2003 CPUE	1999-2003 95% CI
Atl. Spotted Dolphin	MAB	0	-	0.2778	0.0568 – 1.3579	0.0292	0.0059 – 0.1429
Bottlenose Dolphin	NCA	0	-	0.0384	0.0079 – 0.1877	0.0259	0.0053 – 0.1265
Risso's Dolphin	NEC	0	-	0	-	0.0651	0.01332 – 0.3183
Pilot Whale	FEC	0	-	0	-	0.0367	0.0074 – 0.1763
Pilot Whale	MAB	0	-	0	-	0.1346	0.0589 – 0.3073
Pilot Whale	SAB	0	-	0	-	0.0074	0.0015 – 0.0357
Minke Whale	NEC	0	-	0.3307	0.06765 – 1.6165	0.0414	0.0085 – 0.2021

Figure 1. Observed Pelagic Longline effort and turtle interactions during Jan-Mar 2004. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

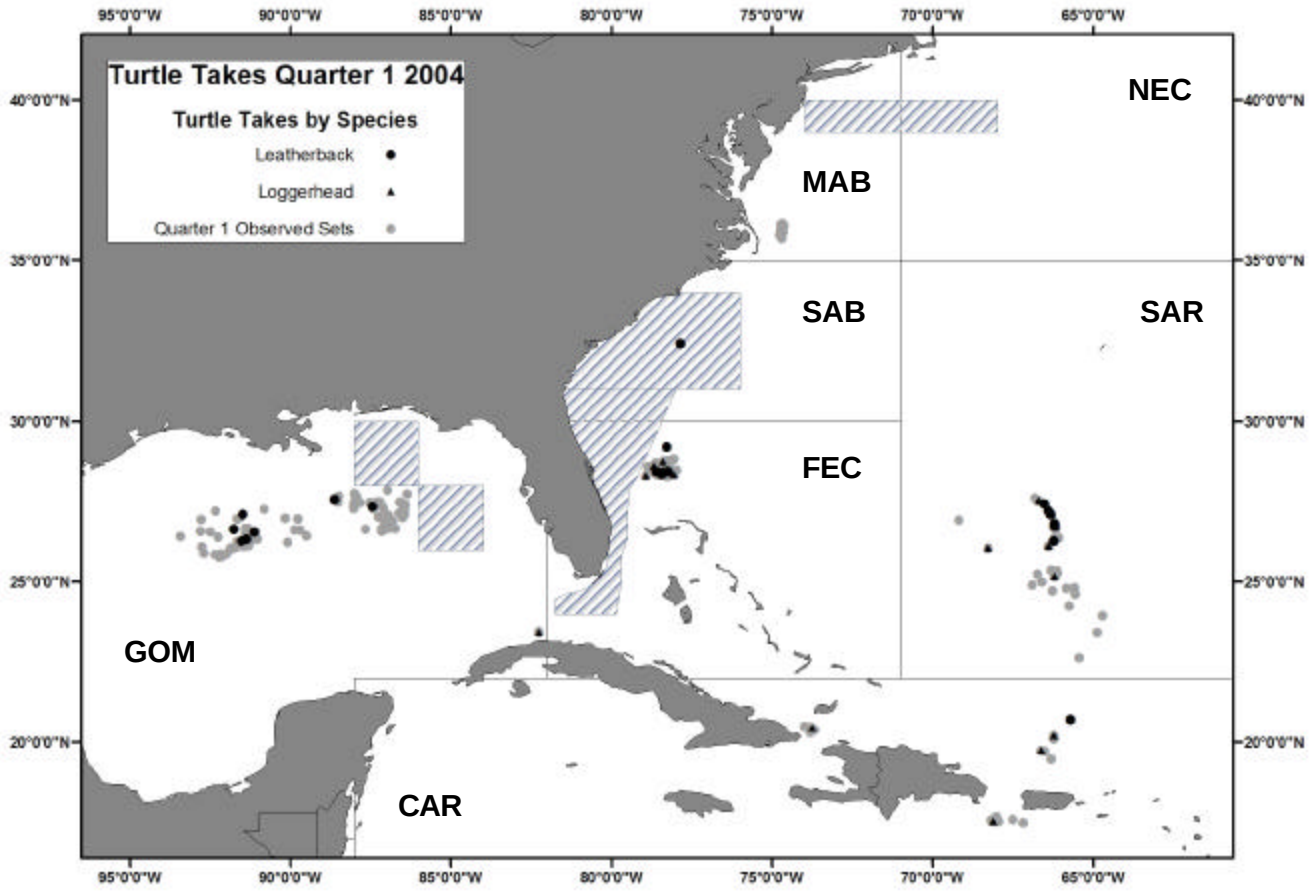


Figure 2. Observed Pelagic Longline effort and turtle interactions during Apr-June 2004. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

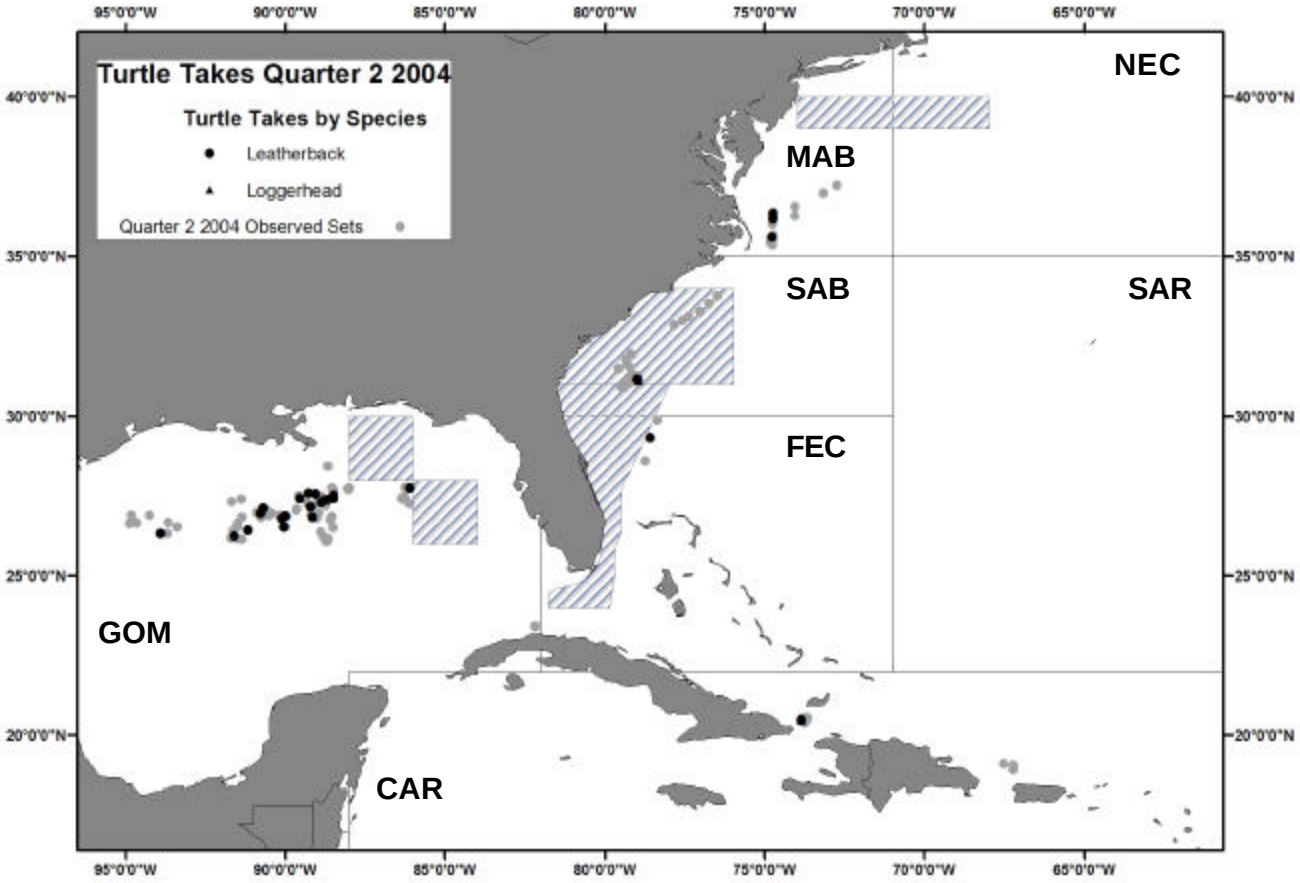


Figure 3. Observed Pelagic Longline effort and marine mammal interactions during Jan-June 2004. All interactions occurred during the first quarter and were with pilot whales (*Globicephala sp.*). Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

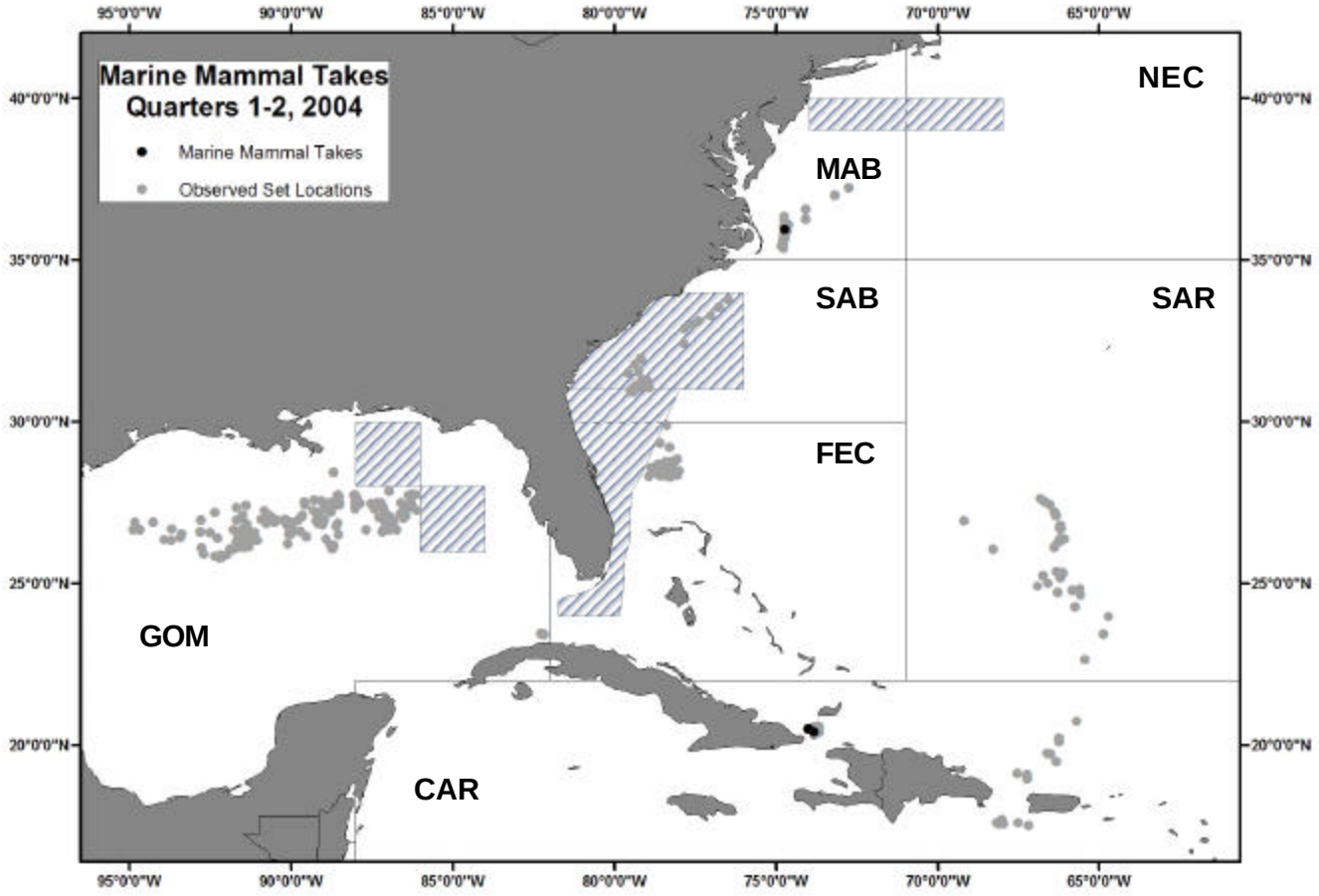
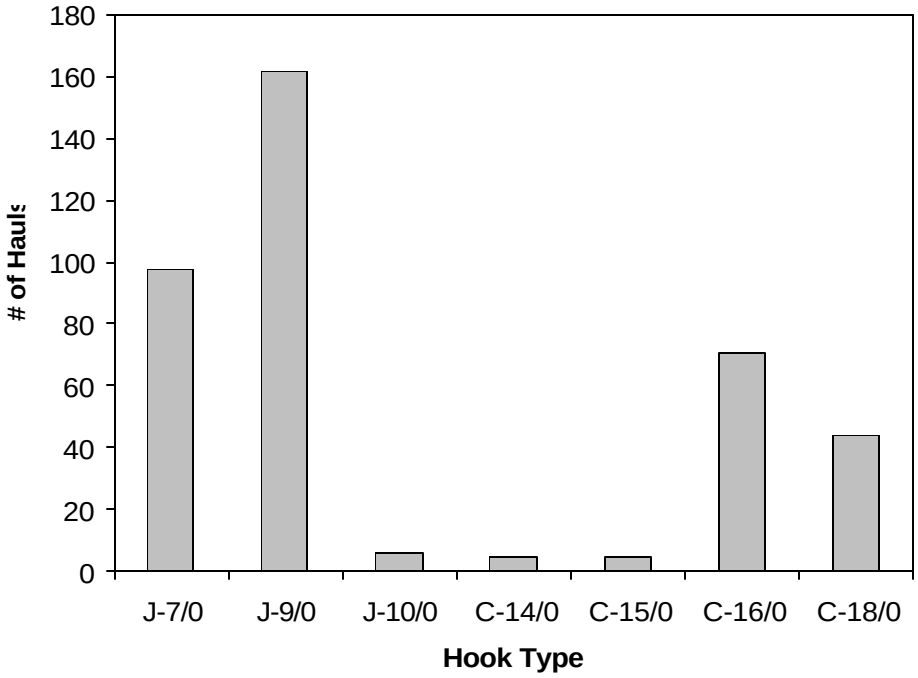
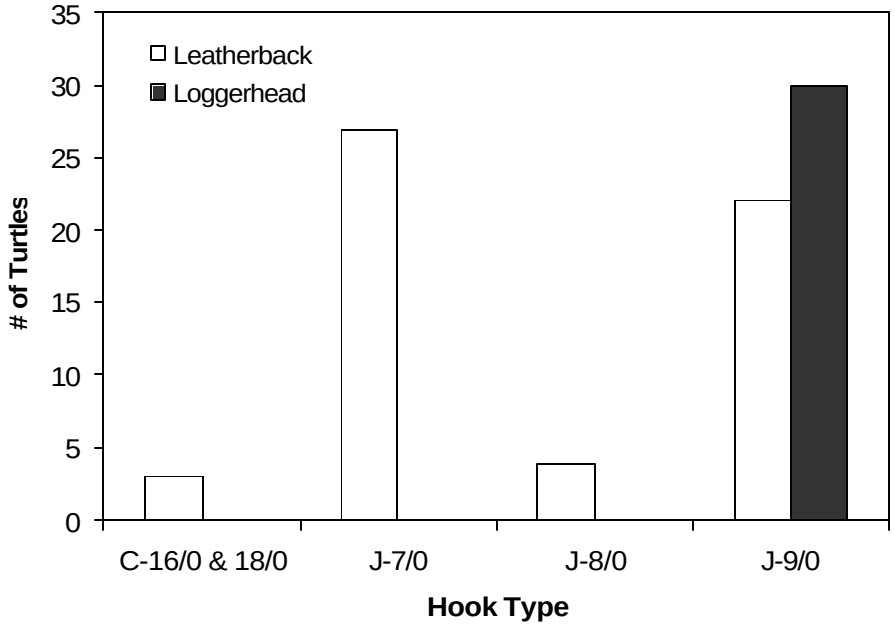


Figure 4. (A) Hook sizes and types observed in the pelagic longline fishery during quarter 1 and quarter 2 of 2004 and (B) the number of turtles captured in sets containing each hook type. 16/0 and 18/0 Circle hooks were used in combination only in experimental sets made in the Gulf of Mexico.

A



B



Appendix A: Injury details and hook type for turtles captured in the pelagic longline fishery during Quarters 1 and 2 of 2004. The hook type indicates the shape ("J" = j type, "C" = circle type) and size of hooks used in the longline set. Sets occasionally used more than one type of hook. Injury information and hook location data are recorded by the observer on the sea turtle life history sheet.

Quarter	Species	Area	Trip #	Haul #	Hook Type 1	Hook Type 2	Release Condition	Hook Location	Jaw Location	Hook Visible ?	Hook removed?	Entangled capture ?	Entangled release ?	Line Left (ft)	CL Est, (feet)	CCL (cm)	Straight N-N (cm)
1	TLB	CAR	M01027	9	J-9/0		alive, injured	shoulder	na		Yes	No	No	0.00	3.40		
1	TLB	FEC	W01038	5	J-9/0		alive, injured	not known if hooked			No	Unknown	No	10.00	5.50		
1	TLB	FEC	W01038	7	J-9/0		alive, injured	armpit	na		No	No	No	30.00	5.00		
1	TLB	FEC	W01038	8	J-9/0		alive, injured	not known if hooked			No	Unknown	No	12.00	5.00		
1	TLB	FEC	W01038	11	J-9/0		alive, injured	neck	na		No	No	No	15.00	5.00		
1	TLB	FEC	W01038	12	J-9/0		alive, injured	unknown internal	unk		No	No	No	10.00	5.00		
1	TLB	GOM	B02007	5	C-16/0	C-18/0	alive, injured	unknown location	unk		No	No	No	0.00	4.00		
1	TLB	GOM	Q02040	1	J-7/0		alive, injured	unknown external	na		No	No	No	1.00	5.00		
1	TLB	GOM	Q02040	2	J-7/0		alive, injured	neck	na		No	No	No	1.00	4.00		
1	TLB	GOM	Q02040	4	J-7/0		alive, injured	neck	na		No	No	No	1.00	4.00		
1	TLB	GOM	S01055	2	C-16/0	C-18/0	alive, injured	front flipper	na		No	No	No	1.00	4.50		
1	TLB	GOM	X02004	4	J-7/0		alive, injured	front flipper/shoulder /armpit	na		No	Yes	No	0.60	4.00		
1	TLB	GOM	X02004	4	J-7/0		alive, injured	front flipper	na		No	No	No	0.60	5.00		
1	TLB	GOM	X02004	5	J-7/0		alive, injured	not known if hooked			NA	Yes	No	0.00	5.00		
1	TLB	SAB	I02017	1	J-9/0		alive, injured	not known if hooked			No	Yes	No	1.50	6.00		
1	TLB	SAR	I02018	6	J-9/0		alive, injured	armpit	na		Yes	No	No	0.00	5.60		
1	TLB	SAR	I02018	7	J-9/0		alive, injured	front flipper/shoulder /armpit	na		Yes	No	No	0.00	5.50		
1	TLB	SAR	I02018	7	J-9/0		alive, injured	carapace	na		Yes	No	No	0.00	6.00		
1	TLB	SAR	I02018	8	J-9/0		alive, injured	armpit	na		No	No	No	3.00	5.80		
1	TLB	SAR	I02018	10	J-9/0		alive, injured	armpit	na		No	No	No	3.00	5.80		
1	TLB	SAR	I02018	13	J-9/0		alive, injured	mouth	unk		No	Unknown	No	1.00	5.00		
1	TLB	SAR	S01054	2	J-9/0		alive, injured	armpit	na		No	No	No	0.50	5.00		
2	TLB	FEC	S01057	4	J-9/0	J-8/0	alive, injured	armpit	na		No	No	No	3.00	4.50		
2	TLB	GOM	B02009	3	J-7/0		alive, injured	unknown external			No	No	No	2.00	4.00		
2	TLB	GOM	P01099	7	J-7/0		alive, injured	mouth	side		No	No	No	0.00	3.00		
2	TLB	GOM	P01100	1	J-7/0		alive, injured	front flipper	na		No	No	No	1.00	4.00		

Appendix A. continued.

Quarter	Species	Area	Trip #	Haul #	Hook Type 1	Hook Type 2	Release Condition	Hook Location	Jaw Location	Hook visible?	Hook removed ?	Entangled capture ?	Entangled release ?	Line Left (ft)	CL Est, (feet)	CCL (cm)	Straight N-N (cm)
2	TLB	GOM	P01100	1	J-7/0		alive, injured	armpit	na	na	No	No	No	1.00	4.00		
2	TLB	GOM	P01100	3	J-7/0		alive, injured	beak (internal)/mouth/ tongue/glottis	side	na	No	No	No	1.00	4.00		
2	TLB	GOM	P01100	7	J-7/0		alive, injured	armpit	na	na	No	No	No	1.00	4.00		
2	TLB	GOM	P01101	5	J-8/0		alive, injured	unknown location		na	No	No	No	3.00	4.00		
2	TLB	GOM	P01101	6	J-8/0		alive, injured	armpit	na	na	No	No	No	3.00	4.00		
2	TLB	GOM	P01101	7	J-8/0		alive, injured	carapace	na	na	No	No	No	5.00	4.00		
2	TLB	GOM	P01101	7	J-8/0		alive, injured	unknown location		na	No	No	No	168.00			
2	TLB	GOM	Q02040	9	J-7/0		alive, injured	shoulder	na	na	No	No	No	8.00	5.00		
2	TLB	GOM	Q02041	3	J-7/0		alive, injured	armpit	na	na	Yes	Yes	No	0.00	5.00		
2	TLB	GOM	Q02042	5	J-7/0		alive, injured	armpit	na	na	No	No	No	6.00	4.00		
2	TLB	GOM	S01056	3	J-7/0		alive, injured	rear flipper	na	na	Yes	Yes	No	0.00	4.50		
2	TLB	GOM	S01056	4	J-7/0		alive, injured	unknown external		na	No	No	No	4.00	5.00		
2	TLB	GOM	S01056	5	J-7/0		alive, injured	front flipper	na	na	No	No	No	6.00	6.00		
2	TLB	GOM	S01056	6	J-7/0		alive, injured	unknown external	na	na	No	No	No	6.00	6.50		
2	TLB	GOM	S01056	6	J-7/0		alive, injured	rear flipper	na	na	No	No	No	8.00	6.50		
2	TLB	GOM	S01056	6	J-7/0		alive, injured	unknown location		na	No	No	No	50.00	6.50		
2	TLB	GOM	U03006	6	J-9/0	J-8/0	alive, injured	armpit	na	na	Yes	No	No	0.00	5.00		
2	TLB	GOM	U03007	3	J-7/0		alive, injured	armpit	na	na	No	No	No	6.00	6.00		
2	TLB	GOM	U03007	4	J-7/0		alive, injured	unknown location		na	No	Unknown	Unknown		6.00		
2	TLB	GOM	U03007	4	J-7/0		alive, injured	shoulder	na	na	No	No	No	5.00	5.00		
2	TLB	GOM	X02006	6	C-16/0	C-18/0	alive, injured	mouth	side	na	No	No	No	0.30	5.00		
2	TLB	GOM	X02008	2	J-7/0		alive, injured	not hooked	na	na	na	Yes	No	0.00	5.00		
2	TLB	GOM	X02008	5	J-7/0		alive, injured	front flipper/shoulder/ armpit	na	na	No	No	No	5.00	5.00		
2	TLB	MAB	I02020	4	J-9/0		alive, injured	armpit	na	na	No	No	No	0.50	4.50		
2	TLB	MAB	W01039	6	J-9/0	J-7/0	alive, injured	carapace	na	na	No	Yes	No	6.00	4.50		
2	TLB	MAB	W01039	7	J-9/0	J-7/0	alive, injured	carapace	na	na	No	No	No	2.00	4.10		

Appendix A. continued.

Quarter	Species	Area	Trip #	Haul #	Hook Type 1	Hook Type 2	Release Condition	Hook Location	Jaw Location	Hook visible?	Hook removed ?	Entangled capture ?	Entangled release ?	Line Left (ft)	CL Est, (feet)	CCL (cm)	Straight N-N (cm)
2	TLB	MAB	W01039	9	J-9/0	J-7/0	alive, injured	armpit	na	na	No	No	No	1.00	6.10		
2	TLB	MAB	W01039	9	J-9/0	J-7/0	alive, injured	carapace	na	na	No	Yes	No	1.00	6.10		
2	TLB	SAB	B02008	6	J-9/0		alive, injured	armpit	na	na	No	No	No	0.50	4.50		
1	TTL	FEC	A02011	2	J-9/0		alive, injured	mouth	other	partial hook	No	No	No	3.00	2.00		
1	TTL	CAR	D04005	9	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.00		71	64.6
1	TTL	CAR	M01026	2	J-9/0		alive, injured	beak internal	lower	na	Yes	No	No	0.50		69.1	64.6
1	TTL	CAR	M01026	5	J-9/0		alive, injured	swallowed	na	not visible	No	No	No	0.50		72.1	65.8
1	TTL	CAR	M01027	9	J-9/0		alive, injured	swallowed	na	not visible	No	No	No	0.50		68.2	61.4
1	TTL	CAR	M01027	15	J-9/0		alive, injured	swallowed	na	not visible	No	No	No	0.50		74.8	67.4
1	TTL	FEC	J02026	4	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	1.00	3.00		
1	TTL	FEC	J02026	6	J-9/0		alive, injured	mouth	lower	na	No	No	No	0.50	2.00		
1	TTL	FEC	W01038	1	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	3.00	2.00		
1	TTL	FEC	W01038	5	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	3.00	1.50		
1	TTL	FEC	W01038	11	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	6.00	1.80		
1	TTL	FEC	X02005	5	J-7/0		alive, injured	unknown internal		not visible	No	No	No	0.50	2.50		
1	TTL	SAB	I02017	1	J-9/0		alive, injured	swallowed	na	partial hook	No	No	No	0.10		64	
1	TTL	SAR	I02018	5	J-9/0		alive, injured	swallowed	na	not visible	No	No	No	0.50		67.2	
1	TTL	SAR	I02018	8	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.20		72.4	
1	TTL	SAR	I02018	8	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.10		72.2	
1	TTL	SAR	I02018	9	J-9/0		alive, injured	swallowed	na	not visible	No	No	No	0.50		64.4	
1	TTL	SAR	I02018	11	J-9/0		alive, injured	swallowed	na	partial hook	No	No	No	0.20		68.8	
1	TTL	SAR	I02018	13	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.10		81.2	
1	TTL	SAR	I02018	13	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.50		78.2	
1	TTL	SAR	I02018	13	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.50		62.2	
1	TTL	SAR	I02018	14	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.20		65.2	

Appendix A. continued.

Quarter	Species	Area	Trip #	Haul #	Hook Type 1	Hook Type 2	Release Condition	Hook Location	Jaw Location	Hook visible?	Hook removed ?	Entangled capture ?	Entangled release ?	Line Left (ft)	CL Est, (feet)	CCL (cm)	Straight N-N (cm)
1	TTL	SAR	I02018	14	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	0.20		81	
1	TTL	SAR	S01054	6	J-9/0		alive, injured	swallowed	na	not visible	No	No	No	0.00		66	
1	TTL	SAR	S01054	6	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	2.00	2.80		
1	TTL	SAR	S01054	13	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	1.00	2.50		
1	TTL	SAR	S01054	13	J-9/0		alive, injured	swallowed	na	unknown	No	No	No	1.50	1.80		
2	TTL	CAR	U03006	4	J-9/0	J-8/0	alive, injured	swallowed	na	partial hook	No	No	No	0.00		71.8	62.9
2	TTL	SAB	B02008	3	J-9/0		alive, injured	swallowed	na	partial hook	No	No	No	0.00		65	59.4
2	TTL	SAB	B02008	6	J-9/0		alive, injured	swallowed	na	partial hook	No	No	No	0.00		75	69.2